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PROGRAM & ABSTRACTS

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O9-03 – S9 *Retrospective analysis of the growth of trees from their anatomy and morphology (ragtag)*
Monday 20 June 20 / 11:00-15:30 – Antigone3

Current tree-ring research and potential in tropical Africa: case-study on commercial timber species from the Democratic Republic of Congo

MAAIKE DE RIDDER[1,2], JAN VAN DEN BULCKE[2], NILS BOURLAND[1,3,4], CÉDRIC ILUNGA[1,5], EMMANUEL KASONGO[1,5], JORIS VAN ACKER[2], HANS BEECKMAN[1]
[1]Royal Museum for Central Africa, Wood Biology Service, 3080, Tervuren, Belgium
[2]Ghent University, Department of Forest and Water Management, 9000, Ghent, Belgium
[3]CIFOR, na, 16115, Bogor, Indonesia
[4]R&SD, na, 048581, Singapore, Singapore
[5]Université de Kisangani, Faculté des Sciences, na, Kisangani, Democratic Republic of Congo

Background: Although many dendrochronological studies in the tropics were successful, studies in the Democratic Republic of Congo remain scarce. Consequently, quantitative growth data are needed to estimate the effects of climate change and document sustainable forest management. Forest exploitation is limited to about 20 tree species of which light-demanding long-lived pioneer species represent the largest volumes on the market. Fortunately, most of these light-demanding tree species are known to form annual tree rings but crossdating is only performed on a limited number of these. This study focuses on tree rings of four Congolese timber species which are rarely used in dendrochronology.
Method: Using classical dendrochronological methods on stem disks and increment cores, we will describe the anatomical structure of tree rings, measure tree rings and construct tree-ring chronologies by crossdating tree-ring series of Pericopsis elata (afrormosia), Entandrophragma cylindricum (sapelli), Milicia excelsa (iroko) and Terminalia superba (limba). Growth responses to climate were analyzed. If evidence is lacking, cambial pinning was performed to confirm the annual character of tree rings. Logging parameters such as the minimum logging diameter were simulated when inventory data were available.
Result: Tree-ring boundaries are annual in all trees and the presence of a marginal (discontinuous) parenchyma band appears the common indicator for tree-ring demarcation. Although intra-tree crossdating was effective, inter-tree crossdating was sometimes difficult. For species with a tree-ring chronology, growth responses to climate were species-specific and no common growth response was observed. For P. elata and T. superba, the simulated logging parameters suggest that current cutting diameters are not hampering sustainable wood production.
Discussion/conclusion: Although we were not able to construct tree-ring chronologies for all study species, the potential of African tree-ring studies is obvious. More samples will help in better unravelling the common growth signal. Therefore, collaborations with forest logging companies are starting up and could eventually lead to more tree-ring chronologies including commercial species like Entandrophragma utile (sipo), Erythrophleum suaveolens (tali)... Although tree-ring analyses appear time-consuming, this method can be considered a price-friendly and fast alternative for periodical inventories of permanent sample plots.

O9-04 – S9 *Retrospective analysis of the growth of trees from their anatomy and morphology (ragtag)*
Monday 20 June 20 / 11:00-15:30 – Antigone3

Understanding plant growth dynamics: links between morpho-anatomical structure and phenology

YVES CARAGLIO[1], DANIEL BARTHÉLÉMY[1], CLAUDE EDELIN[2], ERIC NICOLINI[1], PATRICK HEURET[3]
[1]CIRAD, Umr AMAP, 34398, Montpellier, France
[2]CNRS, IFP, 605001, Pondicherry, Inde
[3]INRA, Umr ECOFOG, 97310, Kourou, France

The scientific community explores numerous issues surrounding the carbon storage of tropical forest ecosystems, taking allometric or functional approaches. There is growing interest in the relations existing between climate change and fluctuations in the functioning of forests, in the leaf phenology of species, and in the relations existing between phenology and wood. Because the trunk constitutes the main biomass of the tree, growth is essentially view in terms of diameter and in height, in a letter. The morpho anatomical structure of stem axes, bearing the leaves and underlying the spatial occupation of plants, is seldom considered. Understanding how the system of tree axes is deployed (primary growth, acquisition of resources) and grows (secondary growth, support, translocation and storage) remains a challenge in carbon sequestration issues, but also in those related to forest dynamics.
The fundamentals of plant architecture can be found in stem morphology (growth processes, branching, etc.) and the natural levels of organization, such as the axis and the phytomer. Some more temporal levels exist (growth unit, module), and others that are more integrating (architectural model, architectural unit), along with reiterated structures. Methods exist for gaining access to this structural information: monitoring to check the temporal aspect of structure formation; retrospective analysis of plant structure.
Reconstructing past development of trees, by combining, in an original manner, the phenology of elongation and thickening on the scale of small branched systems up to the whole plant, reveals the relations existing between leafy shoots, flowering, branching and diameter growth. A comparison with climate data reveals the most susceptible structural variables for a given factor. Architecture plasticity is analysed in terms of balances between leaf/axis (exploitation/exploration of space), elongation/thickening (exploration/support) and brings out some architectural traits and strategies of the tree throughout its ontogeny.
The architectural approach provides a conceptual framework for sampling and integrating large trees. The spatial phenology of primary and secondary growth makes it possible to address the rules of prioritization in response to constraints. This dual approach will involve taking another look at biomass and forest ecology matters (colonization of the environment, invasive plants, reforestation).